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CONTENTS—JULY, 1927

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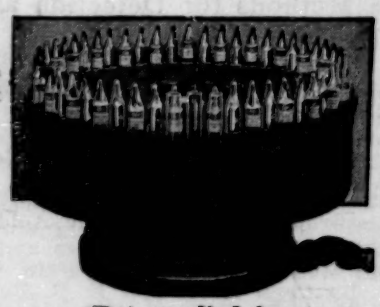

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SCIENCE

VOL. LXVI JULY 8, 1927 No. 1697

CONTENTS

Presentation of the Kober Medal to Dr. William H. Welch: PROFESSOR GEORGE M. KOBER and DR. WILLIAM H. WELCH 21

The Productive Capacity of a University: DR. CHAS. H. HERTY 25

Addison Emery Verrill—Pioneer Zoologist: PROFESSOR WESLEY R. COE 28

Scientific Events:

Airplane Views of Southeastern Alaska; Ocean Weather Charts; The Astronomy and Physics Club of Pasadena; The International Geodetic and Geophysical Union; The Bureau of Chemistry and Soils of the U. S. Department of Agriculture 30

Scientific Notes and News 32

University and Educational Notes 36

Discussion:

The Chattanoogan Age of the Big Stone Gap Shale of Southwestern Virginia: DR. J. H. SWARTZ. *Notes on Heloferma suspectum and Iguana tuberculata:* PENNOYER F. ENGLISH. *A Protest against Cryptic Titles and Indirect Labeling of Figures:* DR. C. T. HURST. *Quotations:* S. FRANCIS HOWARD. *The Metric System:* DR. W. W. KEEN 36

Quotations:

British Colonial Research 38

Scientific Books:

Meisel's Bibliography of American Natural History: PROFESSOR CHARLES A. KOFOID 39

Special Articles:

Effect of Short and Alternating Periods of Light and Darkness on Plant Growth: W. W. GARNER and H. A. ALLARD. *Iron Organisms:* DRS. WILLIAM J. MEEHAN and L. BAAS-BECKING 40

The Iowa Academy of Science: DR. P. S. HELMICK 43

Science News x

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal.

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 8, 1879.

PRESENTATION OF THE KOBER MEDAL TO DR. WILLIAM H. WELCH[1]

REMARKS OF GEORGE M. KOBER

Mr. President and Colleagues:

DR. WARTHIN doubtless with great self-denial, which I deeply appreciate, has assigned to me the most pleasing function in my life, to pay tribute on behalf of this association to William Henry Welch, the father of scientific medicine in America, and the most respected and beloved member of the medical profession. No words of mine can add luster to the laurel wreaths which have been bestowed upon him both at home and abroad, and worn with his innate modesty and dignity for so many years.

It may, however, be a source of inspiration to the younger generation of this association to recount briefly the achievements of a man to whom this country and the world is so greatly indebted.[2]

Dr. Welch was graduated in 1875 at a time when the outlook for the future of scientific medicine seemed brighter than ever before. Pathology under the leadership of Virchow and his pupils had made tremendous strides, and with the birth of bacteriology there was also a ray of hope for the prevention of human suffering and distress.

Welch, with his high ideals and noble aspirations, and conscious of the defects in our medical educational system, was determined to prepare himself well for the practice of one of the most difficult and responsible of all professions. In order to lay the foundations in modern pathology, he journeyed to Strassburg in the spring of 1876, where he pursued studies in normal histology under Waldeyer, physiological chemistry with Hoppe-Seyler and post-mortem demonstrations by von Recklinghausen. Later he went to Leipzig for further work in histology and physiology with Ludwig and Kronecker.

Among foreign students were Pawlow and Drechsel and Flechsig. Welch, in addition to his regular courses, was set by Ludwig to study the ganglia and nerves of the auricular septum of the frog's heart with the gold chloride impregnation method, in the course of which he actually brought into view the

[1] By the Association of American Physicians for Research in Scientific Medicine.

[2] See Simon Flexner's exhaustive Introduction to the Contributions and Addresses of Professor Welch published on his seventieth anniversary, 1920.

ganglionic cells with T-shaped fibers, which Ranvier described in detail somewhat later.

By a singular coincidence I was studying that year at Camp McDermit, Nevada, a collection of 250 specimens illustrating normal and pathological histology prepared in Ludwig's laboratory, and purchased for me by my friend, Dr. John S. Billings, of the U. S. Army.

At the end of his first year of European studies, Welch was fully prepared to take up the solution of unsolved problems in pathology, and his ambition was to do so under the direction of Virchow.

It was perhaps fortunate for our Jubilarian that he accepted the suggestion of Ludwig and others, to go to Breslau and study pathology under Cohnheim, a brilliant pupil of Virchow, then in the prime of life. At all events he spent a most profitable semester dividing his time between the autopsy demonstrations conducted by Weigert and the experimental investigations of Cohnheim. The particular theme assigned to Welch was "The Origin of Acute General Oedema of the Lungs." This thesis prepared in German proved to be a high testimonial to his thorough painstaking scientific qualifications at the age of twenty-eight years, three years after his graduation. It was published in Virchow's Archives and the *Berliner Klin. Wochenschrift* in 1878.

While at Cohnheim's laboratory he met Koch, Cohn, the botanist, Ehrlich and other great foreign students, among them Salomonsen, who afterwards became professor of pathology at Copenhagen.

On his way from Breslau to Vienna, Welch stopped at Prague to see Klebs and his excellent collection of preparations showing micrococci in the ulcerative lesions of acute endo-carditis, he was also equally impressed with his work on diphtheria and experimental syphilis.

In Vienna he entered Stricker's laboratory for experimental pathology, and likewise enjoyed unlimited opportunities with Chiari in gross pathology.

After the Christmas holidays he spent a few days at Würzburg with Rindfleisch and his assistant, Ziegler, and again went to Strassburg to visit von Recklinghausen, who chose as a theme for special study the inflammation of the cornea of the frog and also engaged him in the discussion of a number of other profitable topics. After a visit to Ranvier, the great histologist, and the main hospitals of Paris, he went to London and, according to Flexner, heard Lister lecture at King's College Hospital and shared in the prevailing excitement which arose from Lister's daring surgical exploit of opening the knee joint. Of course Mr. Lister was not aware of the fact that a young "soldier and cowboy doctor" at Camp McDermit, Nevada, had been bold enough two years before to treat successfully a perforating gunshot wound of the knee joint, which had become septic, with tincture of iodine and carbolic acid. Thanks to the advice of Dr. Billings, the case was published in the *Journal of American Medical Sciences* for October, 1876, and also in the third surgical volume of the War of the Rebellion. Although the use of iodine has become almost a universal procedure, I never saw any reference to this case in the surgical texts.

This incident has not shortened my life, and I trust you will pardon this immodest digression, when I tell you it had much to do with the foundation of a lectureship and the association medal, so that the work of members of the various associations with which I was connected might be properly evaluated.

But to resume the life work of the man in whose honor we have met, it is perfectly natural that soon after his return to New York he was offered a teaching position at his alma mater, the College of Physicians and Surgeons, which he declined, but recommended Dr. Thomas M. Prudden. He preferred to accept a professorship at the Bellevue Medical College, largely because of a promise that suitable laboratory facilities would be supplied. Here he lectured on general pathology and demonstrated the pathological lesions preparatory to Austin Flint's brilliant lectures; he also revised and largely rewrote in 1881 the pathological anatomical sections of Flint's "Treatise on the Principles and Practice of Medicine." It is easy to see that his thorough preparation had also attracted the attention of the planners of the Johns Hopkins University Hospital. The prospect of a full-time salaried position, prompted his acceptance in 1884, and with the establishment of the medical school in 1892 he became professor of pathology.

His splendid pioneer work in Cohnheim's laboratory was followed by thirty-three important contributions, many of these like his experimental study of glomerulonephritis, the pathology of fever, thrombosis and embolism, hemorrhagic infarctions, malignant diseases of the stomach were presented or discussed before this body. Among a total of 335 contributions, seventy appear in the transactions of this association.

During the six years after his first European tour, as Flexner has pointed out, the center of interest had begun to shift from Virchow's cellular pathology to microbiology, and the conception of the microbial origin of infectious diseases, based upon the rapid and startling discoveries by Pasteur and Koch and their pupils, appealed very strongly to Welch, especially as he had witnessed Koch's demonstration of his Anthrax work in Cohnheim's laboratory in 1877.

Hence his goal in 1884 was Berlin and Koch. Upon the latter's advice he went first to Bollinger's lab-

oratory at Munich, where he prepared himself under Frobenius in Koch's technique. Here he also met men like Buchner, Esherich, Lehmann, Neumann, Celli and others. He also became interested in animal pathology at the Veterinary School and the diseases transmissible from animals to man, and was likewise an enthusiastic worker in von Pettenkofer's Institute for experimental hygiene. In January, 1885, at the suggestion of Koch he took a course in bacteriology under Flügge at Göttingen, after which he was amply prepared to receive the final touch of preparation in Koch's laboratory, by the great master. Dr. Welch's association with these beacon lights in scientific medicine has always been gratefully remembered and the ties of friendship have never been broken, except by death.

That he has made good use of his opportunities in the field of bacteriology is evidenced by the fact that he himself discovered in 1892 the *staphylococcus epidermides albus* and its relation to wound infection and in the same year also the *bacillus aerogenes capsulatus;* in 1900 he grouped the diseases caused by this organism. In 1891–1892 he with Flexner demonstrated the pathological changes produced by experimental injection of the toxins of diphtheria, simultaneously with Von Behring. How well he cultivated this new field is attested by his thirty-one published contributions to the subject.

Thoroughly equipped as he was in the fundamental sciences of preventive medicine and the first, so far as I know, to enunciate, that the "highest aim of scientific medicine is the eradication of preventable disease," we find him spreading the gospel of public and personal hygiene in 1889, followed by sixteen other important contributions. In addition he devoted twenty-four years (*i.e.,* 1898–1922) of his precious life to the duties and responsibilities of the office as president of the Maryland State Board of Health. His humane efforts have been duly rewarded by the Rockefeller Foundation in the establishment of the School of Hygiene and Public Health in 1916, of which he was the director until a few months ago.

As a keen and competent observer and critic, Dr. Welch had recognized and deplored the glaring defects in medical education in our own country and with a truly patriotic spirit started his campaign for higher medical education in 1886.

Others had called attention to this subject and urged higher standards, and the employment of full-time salaried laboratory men and research workers, without much avail. His twenty-five contributions on medical education, based upon conclusive facts gradually made a profound impression.

The voice of a man, who had become a master in all of the medical sciences, who had turned out a long list of brilliant pupils as successful investigators, who, had stimulated into existence the Rockefeller Institute for Medical Research, and founded the *Journal for Experimental Medicine,* carried great weight, and to him largely belongs the credit for the establishment of full-time professorships and the present most creditable status of scientific medicine in this country.

The American temple of medicine is rapidly fulfilling the hope and expectation of every patriotic citizen, thanks to the generosity of the Rockefeller, Carnegie and numerous private foundations. Some of the most difficult and important problems have been solved, and these achievements have already attracted foreign professors and students, but the temple is unfinished, and to you members of this association and all other research workers the spirit of American genius cries, rear it upwards, upwards to the skies.

In addition to all we owe to Dr. Welch as the Father of Scientific Medicine, we are also greatly indebted to him for his example in the promotion of general culture in the languages, fine arts, poetry and literature. His recent acceptance of the Professorship of Medical History at Johns Hopkins University, is by no means fortutitous. No less than thirty-five contributions to Medical History, indited by his graceful pen, eloquently attest his great interest and fitness for the perpetuation of the memory of great men and noble deeds.

He probably accepted an endowed professorship, so that the good work in this field may be carried on effectively also in this country and thereby stimulate the younger members of the profession to perform deeds worthy of permanent preservation.

In conclusion, my good and beloved friend, let me tell you how much we older members of this association are indebted to you; we have sat at your feet and imbibed words of wisdom and knowledge. The present and future generations of our Association will profit equally well by the perusal of the three volumes of important contributions and addresses, the product of your bright and fertile mind, and it will be their duty and privilege to see that your life and work shall know no death.

It has been truly said that a single flower in a man's buttonhole is worth a ton of roses piled upon his grave. It is therefore a great pleasure to present to you the Association Medal for Research in Scientific Medicine, with the fervent hope that your days of usefulness and bliss may still be many, and that memories of this occasion may linger with you through the evening of life, and like the flowers that bloom in the sunlight spread their fragrance on your path.

REMARKS OF WILLIAM H. WELCH[3]

Mr. President, Dr. Kober, Members of the Association:

I beg to express my deep appreciation of the distinguished honor conferred upon me by the award by this Association of the Kober Medal for Research in Scientific Medicine provided by the Kober Foundation of Georgetown University and accompanied by its diploma.

It adds greatly to my pleasure to receive this medal directly from the hands of my dear friend for well nigh forty years, Dr. George M. Kober, the generous and eminent creator of this foundation. With his accustomed grace, even if in words all too generous in their estimate of the work and service of the recipient, he has performed the function, unusual and, it may be, difficult for a donor, of attempting to justify the action of the association in the bestowal of the medal. I wish time and occasion were suitable for me to say something of Dr. Kober's own important contributions and services to medicine, surgery, hygiene and public health and charities, and indeed I can not refrain from at least expressing here publicly what others as well as I have urged upon him in private conversation—the earnest wish that he should give the profession as well as the public the benefit of an autobigraphical narrative of a long and unusually varied, interesting and useful life.

My pleasure on this occasion is still further heightened by the circumstance that the award of this medal is by this Association of American Physicians, for I was present not only at its birth, but, I think now as the sole survivor, also at its conception, when, if my memory serves me correctly, in January, 1886, a small group of physicians, which included Osler and Pepper from Philadelphia, Francis Minot and Fitz from Boston, and Draper and Kinnicut from New York, were invited to meet in the office of Francis Delafield in New York to consider the desirability of founding a national association of the character realized six months later and of selecting the first founder members. Only those familiar with the factional troubles, the disturbed professional conditions and the general state of medical education, science and art in this country at that time can realize the full significance of the brief introductory remarks of the first president of the association, Dr. Delafield, who had in eminent degree the gift of multum-in-parvo speech, when he expressed our purpose to create a society without medical politics and without medical ethics, where no one cared who the officers were and where one would find fellow-workers in medicine and pathology understanding and capable of intelligently discussing the papers presented, and from whom one could learn. I need not tell you at this forty-second annual meeting that the hopes and wishes of the founders have been fulfilled beyond all expectation in the history of this association, membership in which still remains the high ambition of aspiring young clinicians and pathologists in spite of the later creation of many specialized national societies, not a few of these being offshoots from this parent stem.

Whatever may have been the illusions of those responsible for the bestowal of this medal inscribed as "Awarded for research in scientific medicine," I honestly believe that I am myself under no illusion on this score. I am glad that Dr. Kober has referred to my three years of preparatory graduate study in Germany and to my masters, to whom I owe an inexpressible debt of gratitude, Waldeyer, Recklinghausen, Hoppe-Seyler, Ludwig, Wagner, and above all Cohnheim, and later Robert Koch and Flügge, and to the friendship continued from my student days throughout their lives with Weigert and Ehrlich.

Few have been so fortunate in coming provided with scientific wares from sources such as these upon a scene so ripe for educational and scientific advance and at a time so pregnant in the history of scientific medicine and in finding opportunities so favorable, yes, even hungry for disposal of their wares, however meager these opportunities and these wares may appear in these more favored times, as I had the good fortune to find from 1878 for six years in New York and later and better up to the present day in Baltimore. Few have been more blest with the good will and support of their professional brethren and none more aided by colleagues and by a long line of devoted and loyal assistants and pupils, whose companionship and subsequent success have been the joy of my life.

Last week I saw at the National Academy of Sciences the demonstration by General Carty and Mr. Ives of television, and, if I correctly understood the principle, the seen image comes solely from a multitude of spots of light reflected from the object, whose self-luminescence, if present, appears only as darkness. In citing this example of reflected radiance as applicable to the individual whom you are honoring on this occasion, I trust that I shall not be interpreted as claiming any share in the later achievements of assistants, associates and pupils such as those of that distinguished line of pathologists who became first assistants in my pathological laboratory—to mention only these—beginning with Hermann Biggs, later my successor in the New York laboratory, and contin-

[3] At the session of the Association of American Physicians in Atlantic City on May 4, 1927.

ing in Baltimore with Councilman, Flexner, Barker, MacCallum, now my successor, Whipple and Winternitz.

To you, young men in this audience, to whose scientific papers I have listened with such delight and instruction, an *apologia pro mea vita*—my antiquity is revealed by my Latin pronunciation—would contain a far more useful message for me to deliver than to figure as an example, but on this score here and now I can only plead changed times and conditions no longer calling upon an investigator for activities which may once have seemed desirable.

I should, however, like to claim the privilege of years and of experience in addressing to the younger investigators a few words of advice and of precept, not conspicuously exemplified in my own career, which, though they may be trite, are not, I conceive, needless of emphasis under present conditions.

Allow nothing to divert you from your professional and scientific work. While maintaining a spirit of cooperation, resist the call to give general addresses, especially at a distance from home, to serve on committees, to assume time-consuming administrative duties and to show visitors around laboratories, clinics and buildings. The active scientific investigator should be at least as inaccessible to the intrusion of casual visitors as the financier or the railway president. Interruption beyond two or three years of investigative work is likely to be fatal to its successful resumption. If you have found your problem it should absorb you, and its successful pursuit should make you the happiest of mortals in the consciousness of adding something to the body of ordered knowledge. Strive for and be content with a scientific reputation based upon the judgment of the best workers in your own field, usually a relatively small group. Such reputations are enduring and often unrelated to merely local or even general professional reputations.

Investigators are usually, although not always, the most stimulating teachers, but it should be more widely realized that students in our American medical schools suffer from over-teaching. It is quite as important that educational and scientific institutions should learn how promising investigators may be and often are spoiled, and to protect them as their most precious asset, as it is to provide facilities for research. I firmly believe that the productive years of scientific discovery may be greatly prolonged by recognition and remedy of conditions which at present too often and unnecessarily shorten them.

I have, I fear unpardonably, encroached too long upon these remarks upon this morning's program of scientific papers. Permit me to close by renewed expression of my grateful appreciation of the signal honor of enrollment among the Kober medallists.

THE PRODUCTIVE CAPACITY OF A UNIVERSITY[1]

RICHMOND COLLEGE is a name long familiar to me, for its baseball teams often visited our campus at Chapel Hill when I was connected with the University of North Carolina. Its buildings were familiar through annual visits to Richmond for our football game with Virginia—visits begun always in high hopes of victory and ending all too frequently with a dolorous return after defeat.

Knowing the Richmond College of former years, I was immediately struck with the name University of Richmond on the invitation to take part in these exercises. Securing copies of the catalogue and pamphlet announcements, I rejoiced over the views of the beautiful buildings, constructed and in contemplation; the extension of its teaching of women at Westhampton College; the Schools of Law and of Business Administration; the summer school, and other evident lines of activity.

Having noted the new title "University of Richmond" I naturally looked for an account of its graduate school. This was found to be very limited. May I congratulate the authorities of the university on making no false pretenses in this matter, and in not undertaking work of a more advanced character until the foundation work of the undergraduate departments is thoroughly developed, and adequate facilities have been provided in which the best type of graduate work can be undertaken.

I feel confident, however, that not only the faculty and the board of trustees, but also all those who have supported and will support this institution, agree that if this university is to measure up to the full realization of its name, all hands should be joined in bringing about the development of a graduate department which will equal in the sterling character of its training the work now given by the collegiate schools.

On this occasion I should naturally prefer giving an account of the remarkable achievements in recent years in the field of chemistry, but your problem, as I see it, is a much broader one than chemistry alone. It is fitting, therefore, that we dwell for a short while on the thought of the productive capacity of a university in the full significance of that term. An institution must send forth men and women trained in the methods and imbued with the spirit of research; through the publication of the results of such research it must make its contribution to truth and to the ever-widening bounds of human knowledge.

I note that you contemplate raising an additional fund for endowment. It may be helpful to remind

[1] Address delivered at the dedication of the new chemistry laboratory of the University of Richmond, Virginia, April 11, 1927.

ourselves at this time that when he was entrusted with the wise expenditure of a bequest for the foundation of a university, President Gilman, in his plans for Johns Hopkins University, thought only incidentally of buildings, his main care was to secure outstanding men who through their work with advanced students would create a true university in its highest sense. His success marked a new era in our conception of university training.

The presence of an active graduate school has its stimulating effect upon that undergraduate training which you are now trying to perfect. It removes effectually any disposition in the undergraduate mind to consider thought or knowledge as static. Where research is in progress, undergraduate courses lose all semblance of routine and take on a new significance as foundation work for the higher training which is necessary if one's future is not in all probability to have definitely fixed limitations.

In the graduate school there is training in searching the literature of any subject, in formulating problems with precision, in the careful gathering of facts, in making fair deductions through accurate reasoning and in publishing results in understandable form. Such work and its publications constitute the second productive capacity of a university. Moreover it is an obligation, for the university must through productive scholarship contribute its addition to that great fund of knowledge which makes for human progress.

Men and women trained in this atmosphere, no matter what the thesis subject may have been, possess an equipment which will enable them to undertake any problem with reasonable hope of its solution. There is a tremendous demand to-day for those so trained. We have landed full head-on into the age of research in America.

Eight years ago when the men in the Chemical Warfare Service had been demobilized and many of them were seeking in vain for positions, I wrote an editorial urging those who had not received a Ph.D. degree to return to their universities, no matter at what sacrifice, and complete their graduate training, for the country would need them. Many leaders in chemistry at that time criticized the editorial on the ground that if the plea were heeded, there would be a surplus of such trained men. Time, however, has told a different story. Last year at the meeting of the American Chemical Society in Philadelphia I made inquiry of the heads of the chemistry departments of many of our universities, and the answer was the same in every case. They told me that they had turned out more Ph.D. men that year than ever before, nevertheless, it would have been easily possible to place double the number of men had they been available. Both universities and industries are seeking doctors of philosophy.

The factors which have brought about this wide expansion of research activities are numerous, but there are certain outstanding influences to which I would like to call attention. Because of acute shortages during the war period, the story of coal-tar and the thousands of products made from it gripped the imagination of the public. All through this story there stood out preeminently the great rôle research had played in this remarkable development in a foreign land. To build up that industry in this country, research was again emphasized, and the results were remarkable. It was a true romance of modern industry.

For many years there had been fine research departments in some of our most important corporations, such as the General Electric Company and the Eastman Kodak Company. Unfortunately, however, the real story did not get across until suddenly the country awoke to the fact that wood (methyl) alcohol, which for many years had been made here by destructive distillation of wood, was threatened by the importation of large quantities of synthetic methyl alcohol (methanol). The daily press handled the story extensively, and again the great value of research in industry was advertised. Just then, at the psychological moment, a series of articles entitled "What Price Progress?" appeared in the New York *Commercial*, written by Hugh Farrell, its financial editor. These articles were printed in pamphlet form by the Chemical Foundation and given wide distribution. This was no technical treatise, but a vivid portrayal of how industries which had followed the lead of research had prospered and how oblivion had waited for those who did not make use of this great agency of modern progress. Finally the many investors throughout the nation opened their eyes, and the spirit of research was in the atmosphere.

Along the same line, but going deeper to the root of the matter, was a front page story, appearing one day in the newspapers all over the land, bearing an appeal from Secretary Hoover and a committee of nationally known men, urging voluntary contributions for a fund of two million dollars anually over a period of ten years, for the support of research in pure science in American universities. This appeal was made to business men as a wise investment, on the ground that progress in applied science is conditioned by and dependent upon progress in pure science. In that statement Secretary Hoover, head of the great business department of our government, did not hesitate to state: "The laws discovered by pure science are the basis of applied science and all industrial development."

In similar vein, the Secretary of Agriculture, Mr. Jardine, has, within the last fortnight, stated in his public address at New Haven that, "men were not laying enough emphasis on pure science in proportion to our emphasis on the application of science and were not stimulating and training an adequate personnel in scientific research." Secretary Jardine further stated "the agriculture of the future will be successful in proportion to the extent to which it is shaped and guided by the basic facts revealed by scientific research, especially research in the fields of natural science, economics, engineering and business administration."

Research is truly the word to-day, not as a momentary fad, but as a permanent addition to our national equipment. Within the last week, two striking announcements emphasized in what important ways this new tool is being utilized. The morning papers of April 7 carried the announcement of a new policy by the largest of all our corporations, which is taking definite steps toward the creation of a great department of scientific research; the papers of Friday morning carried an appeal for a fund of $2,000,000 to be used for the benefit of the lepers in the Philippines, not for grounds and buildings where segregated they may pass away the remainder of their lives, but for research and equipment which will go to the root of the matter and drive out this dread scourge from among men.

The South is profiting to-day at every turn by the research which is adding so constantly to science and to the efficiency of industry. As a Southerner I have rejoiced over the news of the great industrial developments in the South and the many evidences of increase of wealth. Then I asked myself this question, "What contribution, in turn, is the South making to research in both pure and applied science?" To answer this question fairly, I have used methods of research and have gone over carefully the *Journal of the American Chemical Society* and *Industrial and Engineering Chemistry,* the publications of our national organization of chemists, and listed by states the origin of all the research articles published in these two journals last year. From this study (Table I) it was found that from the thirteen states south of the Potomac River, namely: Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, Tennessee and Kentucky, there have appeared among the four hundred and twenty-seven contributions to pure science in the *Journal of the American Chemical Society* only twenty-two articles from these states, just 5.2 per cent. Of the two hundred and eighty-four reports of scientific work in *Industrial and Engineering Chemistry,* only twelve were from these states, just four per cent. I regret to

TABLE I

Total Contributions of Results of Scientific Work, in A. C. S. Journals, 1926

	From U. S.	From 13 Southern States	Per cent.
J. A. C. S.	427	22	5.2
I. & E. Chemistry	284	12	4.0
Total	711	34	4.8

Contributions from Universities in U. S.

	From U. S.	From 13 Southern States	Per cent.
J. A. C. S.	348	22	6.3
I. & E. Chemistry	103	5	4.8
Total	451	27	6.1

record that from the states of West Virginia, South Carolina, Georgia, Alabama, Mississippi and Louisiana not a single contribution was made. I regret to recall that among the three hundred and forty-eight contributions from university laboratories printed in the *Journal of the American Chemical Society* in 1926, there is not a single communication from a university in any of the following Southern states: West Virginia, South Carolina, Georgia, Alabama, Mississippi and Louisiana. Of the many contributions to applied science in *Industrial and Engineering Chemistry,* there is not a single paper from a university in the following states: West Virginia, Virginia, South Carolina, Georgia, Florida, Alabama, Louisiana, Texas, Arkansas and Kentucky.

I shall make no effort to assign the blame for this deplorable state of affairs, whether it be shortsightedness of legislatures or penuriousness of men of wealth in the South, the lack of understanding by the executives of our Southern institutions, or the deep rut of routine into which professors have without adequate remonstrance allowed themselves to be thrown.

One thing is certain, it is time for an awakening and for a wholehearted union of forces and of effort in order that this great section of our country should meet its full obligations and take its proper place in the progress of America.

May the University of Richmond, situated in this great city of the new South, soon find itself in position to contribute its full quota to the research output of the nation and to offer to the men and women who come within its walls a future of unbounded possibilities.

CHARLES H. HERTY

THE CHEMICAL FOUNDATION,
NEW YORK, N. Y.

ADDISON EMERY VERRILL: PIONEER ZOOLOGIST

IN an attempt to gain some conception of the zoological influence of the life work of Professor Addison Emery Verrill, whose death occurred on December 10, 1926, there is brought to mind the enormous progress which has been made in the science of zoology during his lifetime. Beginning his scientific studies at the time of the arrival of Louis Agassiz in this country, bringing with him the concepts of comparative morphology which were commencing to supplant the earlier systematic work in Europe, Verrill was able to follow the entire course of zoological progress to its culmination in the experimental methods of the present day.

Although Verrill did not directly participate in these more modern phases of biological research, he fully realized that much of the more recent work has been possible only because of the foundations laid by a small group of able men who, since the middle of the last century, have explored the vast fields containing previously undiscovered forms of life and have thus made known the morphology, natural history and relationships of the organisms available for more specialized and experimental investigation.

Among these pioneer zoologists the name of Verrill stands out prominently because of the amount and accuracy of his contributions to our knowledge of marine invertebrates. More than a thousand species, including representatives of nearly all groups, were discovered and described by him, and their relationships to previously known forms were diagnosed with almost unerring accuracy and with a facility that amounted almost to genius.

He was much more than a systematic zoologist, however; he was a real naturalist in that he was always interested in the natural history of the animals which he studied as well as the morphological characters which distinguished the species new to science. His work on the natural history of the marine invertebrates of southern New England was the first extensive ecological study of its kind in America, and his Vineyard Sound report (published in 1871) was the standard reference book for all students of the seashore life of the region for more than thirty years.

Entering Harvard as one of the early pupils of Louis Agassiz, young Verrill, even while an undergraduate student, explored zoologically and geologically the island of Anticosti and parts of the coast of Labrador. Receiving his bachelor's degree at Harvard in 1862, he remained as assistant to Agassiz in the Museum of Comparative Zoology, for two years a position in which he had already served while still an undergraduate. During this time he made a comprehensive study of the radiate animals and systematized the classification of the coelenterates.

In 1864 Verrill was called by Yale to bring to that institution the new science of zoology as developed by Agassiz and to serve as her first professor of that subject. This position he held for forty-three years, until his retirement in 1907, at which time he was made professor emeritus.

When appointed at Yale he was but 25 years of age, having been born at Greenwood, Maine, February 9, 1839. It is perhaps needless to state that a naturalist of such exceptional ability in his manhood exhibited similar talents in his boyhood. At the age of thirteen he had learned to recognize the minerals and rocks of his native town. He later made a collection of nearly a thousand species of plants, each of which he remembered throughout the remainder of his life, and at seventeen he began a collection of the local shells, insects, amphibia, reptiles, birds and mammals, making the identification, when possible, with the aid of such few books as were available and noting especially the kinds which were different from any described in his books. In this way, and wholly without other assistance, he laid a broad foundation for the taxonomic studies which were to constitute his life work. These boyhood studies in natural history began to bear fruit in the years 1862 and 1863 when he published no less than twenty-two papers, of which two were on minerals, one on plants, three on corals and their allies, seven on birds, four on animals, three on amphibians and the others on general natural history. Most of these were brief taxonomic papers or lists of species, but one of them, on the revision of the Polypi of the eastern coast of the United States, showed a remarkable comprehension of the principles of taxonomy.

In 1871, when the United States Fish Commission inaugurated a comprehensive survey of the waters off the coast of New England with the object of securing information regarding the environment of the commercial fisheries, Verrill was selected as the logical person to take charge of the scientific investigations. And from that time until 1887 there came into his hands an almost continual stream of material dredged from the ocean bottom and containing a great number of forms of animal life quite different from any that had been previously known. These were busy years, with numerous publications describing the new things that were discovered, and before the work was discontinued the Peabody Museum at Yale had become the repository of hundreds of thousands of specimens, among them being several hundred species previously unknown.

Instead of distributing this mass of material to specialists as is the rule at the present day, Verrill

vered all the groups of invertebrates except the rotozoa, and it was his intention to summarize the sults of his extensive studies on the marine inverte-ates of the New England coast by writing a mono-aph on each group. Several groups were com-eted and published, but other manuscripts, with ndreds of drawings, were left unfinished at the time his death.

For his was the spirit of the pioneer, ever seeking w forms of animal life for study, and having ex-usted the more interesting forms from New En-land he next turned his attention to the Bermudas, king three trips to the islands. In 1901–1902 he blished two volumes, containing not only the results his studies in his special field, but also a brief torical survey of the settlement and social colonial velopment of the islands, their physiography and ology, and the effects of civilization on the native ora and fauna, the whole forming a very compre-nsive summary of the natural history of this popu-r vacation land.

For nearly twenty years after reaching the retiring e limit, in 1907, Verrill continued his studies with abated energy, publishing in this period a series papers which constitute in many respects his most portant contributions to science. These reflect his turity of judgment and his accumulated knowl-dge from so many years of research.

These works summarize his knowledge of the corals d allied animals, the starfishes and allies, and the stacea, covering more than a thousand pages and lustrated by some two hundred plates. Some time fore his death he had placed in the hands of the blishers his most extensive monograph, on the cyonaria, consisting of upwards of a thousand ges and 150 plates. There is also awaiting publi-tion a report on the crustacea of Connecticut with r a hundred plates. A more detailed summary of contributions to zoology and a condensed bibli-raphy of his publications may be found in the *erican Journal of Science,* May, 1927.

Verrill's work was continued almost uninterrupt-ly until the last few weeks of his life. Even at age of eighty-five, still sturdy and vigorous, he barked on a new voyage of discovery on Kauai land, in the Hawaiian group, with all the enthu-m that he had shown when Agassiz sent him to brador and Anticosti in his student days. Two rs spent at that island, and nearly a thousand of marine invertebrates were collected, including mbers of the new species which he was seeking. remarkable vitality, however, was at last ex-usted and after bringing the collection back to w Haven he was unable to complete its study. the autumn of 1926 he left for California to spend winter with his son, but he died a few weeks after his arrival. He was within two months of having completed his eighty-eighth year.

His publications extended over a period of forty-four years. During this long period of activity he published more than 350 papers on geological and biological subjects, making known to science more than a thousand new species of marine invertebrates, and revised the classification of almost every group. That he was able to accomplish so much is due not only to the very unusual number of years that he was able to work, but also to his ability to continue the most arduous mental tasks for many hours each day, with never a thought of recreation and an almost incredible minimum of sleep. That his diagnoses were so accurate and that he could cover so wide a field is due in part to his marvelous memory; he seldom forgot anything of importance connected with his work and could recall the characteristics of almost every one of the thousand animals to which he had given names.

The definition of all the zoological terms in the 1890 edition of Webster's International Dictionary were prepared by Verrill, and by him the hundreds of accompanying illustrations were selected. One can hardly open this great volume without having before his eyes testimony of Verrill's remarkable breadth of scholarship.

For forty-five years (1865–1910) he was in charge of the zoological collection belonging to Yale University. Through his agency the collections increased from almost nothing to one of the most extensive in any university museum in the country.

The honorary degree of M.A. was conferred upon him by Yale and he was honored by being appointed lecturer at the Lowell Institute in Boston in 1899. He was a member of the National Academy of Sciences, for some years president of the Connecticut Academy of Arts and Sciences, a corresponding member of the Societé Zoologique de France, a fellow of the American Association for the Advancement of Science and a member of many learned societies. From 1869 to 1920 he was associate editor of the *American Journal of Science* and he served as professor of comparative anatomy and entomology at the University of Wisconsin in 1868–70 and as a curator of the Boston Society of Natural History for some years, in addition to his professorship at Yale.

In 1865 Professor Verrill married Flora Louisa Smith, a sister of the late Professor Sidney I. Smith, of Yale. Mrs. Verrill died in 1915. Four of their six children survive, the two sons being Major George E. Verrill and Alpheus Hyatt Verrill.

WESLEY R. COE

YALE UNIVERSITY

SCIENTIFIC EVENTS

AIRPLANE VIEWS OF SOUTHEASTERN ALASKA

IN order that the "phototopographic" views made in southeastern Alaska last summer by the Navy Department at the request of the Geological Survey may be available to the general public at as early a date as possible, arrangements have been recently entered into between the Geological Survey of the Interior Department and the Forest Service of the Department of Agriculture whereby prints of the pictures may be obtained at a small price. It should be distinctly understood, however, that several prints of adjacent areas can not be jonied so as to form an undistorted mosaic.

Nearly 5,000 sets of exposures were made during the summer, each consisting of three parts—a central picture which represents the ground directly under the airplane and two side pictures which represent adjoining areas on each side of the central picture. The central picture is taken with a camera pointed vertically downward, and the two side pictures are made at the same moment by two supplementary cameras directed obliquely to each side and fixed at a definite angle to the vertical. A set of three pictures thus taken represents an area of about 11 square miles when the plane flies at the preferred elevation of 10,000 feet, and the whole series covers practically all of southeastern Alaska except Baranof and Chichagof Islands.

As rapidly as possible official sets of all the prints will be made, and one set will be placed on file for inspection in the district office of the Forest Service at Juneau, Alaska, and another in the office of the Alaskan branch of the Geological Survey, at Washington, D. C. More than one half of the prints have now been completed, and it is hoped to have the entire set ready by October 1. Orders for prints may be made by number from these file sets. Those to whom these file sets are not readily accessible may request from the Forest Service, Washington, D. C., a copy of an index map which shows the location of the area covered by each photograph or may forward orders specifying the location of the precise tract of which photographs are desired, the name of the island on which the tract is located, and the size of the tract.

OCEAN WEATHER CHARTS

PREPARATION of complete ocean weather charts and dependable forecasts every day for the benefit of aircraft navigators, as well as masters of water craft on the North Atlantic, is a project which the United States Weather Bureau hopes to accomplish within the near future.

The transatlantic airplane flights have stimulat the receiving of ocean weather reports, enabling t bureau to keep the recent Byrd flight well advised to the winds, storms and fogs which would be countered in the crossing. This service was ma possible largely by the voluntary cooperation of sh masters and of the radio companies, which collect the ocean weather information twice daily and d livered it to the bureau for charting and analysis.

In future transatlantic flying such voluntary coope tion will hardly be as readily forthcoming since t novelty of the enterprise will be gone and public inter less keen. Officials of the Weather Bureau are acco ingly figuring out what can be done to stimulate inter in ocean weather reports to add to the safety of fly and of navigation. It is their hope that shipmast will continue the work when the present flying sea is over. Nevertheless, something more permanently pendable is essential.

That a more complete and extensive organization the ship service is necessary is shown by the fact t on some days while the fliers were waiting for favora conditions the Weather Bureau did not get a sin ship report from areas a thousand miles wide in t Atlantic. Even on May 18, two days before Lindbe made his successful flight, no report was received fr any ship between midocean and the Irish Coast. was not until he had started that weather reports fr ships became nearly adequate. When Chamberlin m his flight the amount of information coming in w more abundant than in any previous period.

Eventually, when funds and facilities permit, t Weather Bureau hopes to get reports twice daily from ships in the Atlantic lanes. Such reports, supplemen by reports from land stations in this country, Can Greenland, Iceland and Europe, would make poss the preparation of complete ocean weather charts dependable forecasts every day.

THE ASTRONOMY AND PHYSICS CLUB PASADENA

THE following is the program of the Astron and Physics Club of Pasadena for the last half ye

January 7. Series Spectra of Boron, Carbon, Nitro Oxygen and Fluorine: Dr. I. S. Bowen.

" 14, 21, 28. Statistical Mechanics: Dr. R. C. man.

February 4, 5. Conference on the Michelson-Morley periment: Dr. A. A. Michelson, Profe H. A. Lorentz, Professor D. C. Miller, P fessor E. R. Hedrick, Professor P. S. stein, Dr. R. J. Kennedy. (A comp report of this conference will be publis later.)

" 11. The Electrostatics of the Thunder Sto Dr. A. W. Simon, National Research Fel

bruary 17, 18. The New Quantum Mechanics: Dr. E. Schrödinger, professor of mathematical physics at the University of Zurich.

rch 4. The Theory of the Breakdown of Dielectrics: Professor A. Joffé, of the Physical Technical Roentgen Institute of Leningrad.

" 11. Some Characteristics of Solar and Stellar Atmospheres: Dr. Charles E. St. John.

pril 1. Doublet Separation and Fine Structure of the Balmer Lines of Hydrogen: Dr. Norton A. Kent, professor of physics, Boston University.

" 8. Absolute Intensities of Lines in the Pure Rotation Spectrum of HCl: Dr. R. M. Badger.

" 18. "Newton": Professor H. H. Turner, of Oxford University, England.

" 22. The Scandium Spectrum: Professor Henry Norris Russell, of Princeton University.

" 29. Theory of Precision Clocks and other Regenerative Systems: Mr. V. H. Benioff.

y 6. On the Theory of Compton Effect: Dr. P. S. Epstein.

" 13. Recent Research in Line and Band Spectra: Dr. L. A. Sommer, of the University of Göttingen.

" 20. The Theory of the Davisson-Germer Experiment: Drs. C. Eckart and F. Zwicky.

" 27. The Shift of Spectroscopic Lines with Pressure: Mr. H. D. Babcock.

e 3. Some Evidences as to the Ultimate Nature of Magnetism: T. D. Yensen. Photo-electric Fatigue: F. L. Poole.

THE INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION

The list of delegates and guests of the American ophysical Union to the third general assembly of International Geodetic and Geophysical Union ich meets at Prague from September 3 to 10, ines:

r. Louis A. Bauer, director, Department of Terrest Magnetism of the Carnegie Institution of Washton, accompanied by Mrs. Bauer.

r. William Bowie, chief of the division of geodesy the U. S. Coast and Geodetic Survey, accompanied Mrs. Bowie and their adult son.

r. J. H. Dellinger, senior physicist of the radio tion of the U. S. Bureau of Standards, accompanied Mrs. Dellinger.

ommander N. H. Heck, chief of the division of estrial magnetism and seismology, U. S. Coast and detic Survey.

r. W. D. Lambert, mathematician of the division geodesy, U. S. Coast and Geodetic Survey, accomied by his sister, Miss Mary B. Lambert.

r. R. A. Millikan, director of the California Institute Technology, Pasadena.

r. Harry Fielding Reid, professor of dynamic geol- of the Johns Hopkins University, Baltimore.

Professor L. C. Graton, of the department of geology, Harvard University, Cambridge, Mass., will attend as a guest.

The following resolutions were adopted by the American Geophysical Union during its eighth annual meeting on April 29:

Resolutions on Translations of Reports on Seismological Investigations published in the Japanese Language

(Submitted by Section of Seismology)

Whereas, It has become known that the reports of much of the seismological investigations carried on in Japan will hereafter be published in the Japanese language only, and

Whereas, This procedure is calculated to deprive most of the American students in this field of research of the advantages of this literature, be it

Resolved, That this matter be brought to the attention of the National Research Council in the hope that the council may provide that this literature be rendered into English, also that provision be made whereby mimeographed copies of these translations be supplied investigators at research institutions gratis and to business concerns, insurance companies, and others interested at cost, and

Resolved, Further, that, should such an arrangement be feasible, a committee of the Geophysical Union be empowered to make a choice of the material to be so translated and distributed.

THE BUREAU OF CHEMISTRY AND SOILS OF THE U. S. DEPARTMENT OF AGRICULTURE

Dr. Charles Albert Browne, chief of the bureau of chemistry of the United States Department of Agriculture, has been designated acting chief of the new Bureau of Chemistry and Soils, which takes form July 1. Dr. A. G. McCall, of the University of Maryland, has been selected to head the department of soils and will take the place of Professor Milton Whitney, who has headed this work since its organization in the department, but who is now obliged, on account of ill health, to relinquish exacting administrative duties. Professor Whitney will devote himself to writing up results of important investigations on which he has been engaged for many years.

A. G. Rice, assistant to the chief of the Bureau of Soils, has been given the same position in the new bureau.

Dr. McCall was a member of the scientific staff of the Bureau of Soils from 1901 to 1904. He left the Department of Agriculture to become assistant professor of agronomy in the Ohio State University and was soon made head of that department, holding the position until 1916 when he became head of the de-

partment of soils and geology in the University of Maryland.

Maryland was the first state to start soil survey work and the first to complete it. The work was started under Professor Milton Whitney and completed under Dr. McCall.

Dr. McCall received his B.Sc. degree from the Ohio State University in 1900 and his Ph.D. from the Johns Hopkins in 1916. He is a member of the Society of Agronomy, the American Association for the Advancement of Science, the Society for the Promotion of the Agricultural Science, and of many other scientific and agricultural organizations. He was executive secretary of the First International Congress of Soil Science recently held in Washington, and has been active in promoting soil science as a writer and investigator.

The new Bureau of Chemistry and Soils combines the research divisions of the old Bureau of Chemistry, the Bureau of Soils, and the Fixed Nitrogen Research Laboratory. The regulatory work formerly carried on by the Bureau of Chemistry has been combined with the regulatory work in the Insecticide and Fungicide Board and all will be administered in the new Food, Drug and Insecticide Administration.

The Civil Service Commission recently held an examination for the position of chief and assistant chief of the newly created bureau. From the list of eligibles the secretary of agriculture expects soon to select the permanent head. Dr. Browne has expressed a desire to devote his energies to chemical research, but has consented to handle the general administrative work temporarily.

SCIENTIFIC NOTES AND NEWS

DR. ELIAKIM HASTINGS MOORE, professor of mathematics in the University of Chicago, a past president of the American Association for the Advancement of Science, has received the degree of doctor of science from the University of Kansas. Northwestern University, where Dr. Moore was formerly professor of mathematics, also conferred on him the doctorate of science as "a productive scholar whose publications are marked by their originality, finished character and far-reaching significance; the recognized leader among American mathematicians."

THE University of Michigan on the occasion of the recent commencement conferred the degree of doctor of science on Dr. Alexander Ziwet, for many years professor of mathematics in the university and professor emeritus since 1925; and on Dr. Willis Rodney Whitney, since 1901 director of the research laboratories of the General Electric Company.

DR. JAMES M. ANDERS, professor of medicine in t University of Pennsylvania, received the degree doctor of science on the occasion of the commenceme exercises of Bowdoin College.

DR. ALEXIS CARREL, of the Rockefeller Institute f Medical Research, has been elected correspondent the Paris Academy of Sciences in the department medicine and surgery.

AT Princeton University Professor Edwin Gr Conklin has been appointed Henry Fairfield Osbo research professor of biology; Professor K. T. Com ton, Cyrus Fogg Brackett research professor physics, and Professor Hugh Scott Taylor, David Jones research professor of chemistry.

PROFESSOR F. G. DONNAN, professor of gene chemistry in the University of London, has be elected a member of the Royal Academy of Scienc of Amsterdam, filling the vacancy caused by the dea of Professor C. Golgi, of Pavia.

THE University of Oxford conferred the honora degree of D.Sc. upon Sir Robert Hadfield, Bart., a Dr. Richard Willstätter, professor of chemistry in t University of Munich, on June 30.

Nature reports that the Senatus Academicus of t University of Edinburgh has agreed to offer the gree of doctor of laws to the following, for conf ment at the special graduation ceremonial on July on the occasion of the visit to Edinburgh of the Brit Medical Association: Lord Dawson, of Penn, physic in ordinary to His Majesty the King; Dr. A. Don (Manchester); Dr. C. E. Douglas (Cupar); William Hale-White (London); Mr. R. G. Hoga (Nottingham); Dr. W. Hunter (London); Dr. T. Milroy (Belfast); Sir Berkeley Moynihan, B (Leeds); Sir J. H. Parsons (London); Sir Humph Rolleston, Bart. (Cambridge); Dr. G. F. Still (L don); Mr. W. Trotter (London); Sir Almroth Wri (London); Professor Vittorio Ascoli, professor clinical medicine, Rome; M. Jules Bordet, director the Pasteur Institute, Brussels; Dr. Harvey Cushi professor of surgery, Harvard University; Dr. C. Dana, professor of nervous diseases, Cornell Univ sity; Professor Knud Faber, professor of medici University of Copenhagen; Dr. Jan van der Hoe professor of ophthalmology, University of Leyde Dr. Otto Meyerhoff, professor of physiology, Univ sity of Berlin; Dr. Otto Naegeli, professor of me cine, University of Zurich; Dr. W. S. Thayer, p fessor emeritus of medicine, Johns Hopkins Univ sity, and M. T. M. Tuffier, Academy of Medici Paris.

THE International Anesthesia Research Society p sented on May 16 to Dr. Arno B. Luckhardt, profes

of physiology, University of Chicago, and T. Bailey Carter, D.Sc., a scroll of recognition in appreciation of "meritorious research in anesthesia and analgesia, and for prolonged, untiring and resultful experimental laboratory studies of the biochemistry and pharmophysiopathology of ethylene, as well as such splendid cooperation of pure with applied science as enabled the surgeons, specialists and anesthetists of the Presbyterian Hospital (Chicago) to rapidly establish the clinical use of ethylene as a new and valuable routine method of anesthesia for the benefit of suffering humanity."

THE Cross of Knight of the Czechoslovak Order of the White Lion, a decoration for citizens of foreign states in appreciation of their services rendered on behalf of Czechoslovakia, has been awarded to the following American engineers by the Czechoslovakian Government: Professor Joseph W. Roe, head of the Department of Industrial Engineering, New York University; Calvin W. Rice, secretary of the American Society of Mechanical Engineers; Alfred D. Flinn, director of the Engineering Foundation, New York; Lawrence W. Wallace, executive secretary of the American Engineering Council, Washington; H. S. Person, managing director of the Taylor Society, New York, and Morris L. Cooke, an industrial engineer of Philadelphia.

DR. JOHN JOHNSTON, previously chairman of the department of chemistry of Yale University, on July 1 took up his work as head of the new research department of the United States Steel Corporation. He intends to spend several months visiting various plants and studying metallurgical problems and practices, after which he will organize an adequate research laboratory. It has not yet been determined where it will be established.

PROFESSOR ARCHIBALD VIVIAN HILL, F.R.S., who recently returned to England after having lectured during a semester in Cornell University, has been elected honorary fellow of King's College, Cambridge.

SIR RICHARD T. GLAZEBROOK, formerly director of the British National Physical Laboratory, has been appointed a member of the Advisory Council for Scientific and Industrial Research.

DR. DONALD B. VAN SLYKE, of the Rockefeller Institute for Medical Research, has been elected president of the Harvey Society for the ensuing year.

THE recently elected officers of the American Society of Plant Physiologists for the year 1927–28 are: *President,* Charles A. Shull; *vice-president,* William E. Tottingham. The *secretary-treasurer,* elected last year for a term of two years, is Scott V. Eaton.

AT the annual meeting during the last week in June of the Society for the Promotion of Engineering Education at the University of Maine the following officers were elected: *President,* R. L. Sackett, Pennsylvania State College; *vice-presidents,* C. E. Magnusson, University of Washington, T. E. French, Ohio State University; *secretary,* F. L. Bishop, University of Pittsburgh; *treasurer,* W. O. Wiley, of Messrs. John Wiley and Sons.

DR. GEORGE K. BURGESS, director of the Bureau of Standards, was elected president at the twentieth National Conference on Weights and Measures held at the Bureau of Standards from May 24 to 27.

PROFESSOR G. S. WHITBY, of McGill University, has been elected president of the Canadian Institute of Chemistry for 1927–8.

PROFESSOR THEODORE W. RICHARDS, of Harvard University, and Professor James F. Norris, of the Massachusetts Institute of Technology, have been appointed honorary chairman and honorary vice-chairman, respectively, of the committee in charge of the seventy-sixth meeting of the American Chemical Society, which will be held in September, 1928, at Swampscott, Mass., under the auspices of the Northeastern Section. The general chairman is Dr. Gustavus J. Esselen, Jr., vice-president of Skinner, Sherman and Esselen, Inc., Boston, Mass., and the executive secretary is Professor Lester F. Hamilton, of the Massachusetts Institute of Technology.

AT the recent Annual Convention of the Association of Cereal Chemists held in Omaha the following officers were elected: *President,* Mr. Leslie R. Olsen, The International Milling Co., Minneapolis, Minn.; *vice-president,* Mr. C. E. Mangels, North Dakota Agricultural College, Fargo, N. D.; *secretary-treasurer,* Mr. R. K. Durham, The Rodney Milling Co., Huntzinger Bldg., Kansas City, Mo.; *editor of Cereal Chemistry,* Dr. C. H. Bailey, University Farm, St. Paul, Minn.; *business manager,* Mr. C. G. Ferrari, University Farm, St. Paul, Minn. Mr. Roland J. Clark was appointed by Mr. Olsen as chairman of the Association's Committee on Publicity.

AT a meeting of the Board of National Research Fellowships on May 27 and 28, the following additional appointments were made: *Reappointments:* Bacteriology, Albert Haldane Gee; Botany, R. E. Girton, L. Joseph Klotz and Lewis E. Wehmeyer; Psychology, Harry R. De Silva, M. F. Metfessel, R. H. Seashore; Zoology, C. Dale Beers, Margaret R. Murray, E. A. Swenson and R. L. Zwemer. *New Appointments*: Botany, James M. Fife, Frederick H. Frost and M. B. Linford; Psychology, C. P. Heinlein and Louis William Max; Zoology, F. W. Appel, D.

R. Briggs, F. J. Brinley, Robert H. Luce and Jack Schultz.

DR. P. W. ZIMMERMAN, dean of the College of Agriculture at the University of Maryland, has accepted a position on the staff of the Boyce Thompson Institute for Plant Research at Yonkers, New York. He will have charge of the experimental work in vegetative propagation. Propagation problems have become very urgent for American nurserymen and horticulturists, especially in view of the quarantine which will be in full operation by 1930.

R. H. BELL, who has been assistant director of agricultural extension work at State College, has been appointed director of the Bureau of Plant Industry in the Pennsylvania Department of Agriculture at Harrisburg.

DR. RALPH C. P. TRUITT, director of the department for the prevention of delinquency of the National Committee for Mental Hygiene, has been appointed director of the clinic of the Mental Hygiene Society of Maryland, to which a grant of $23,000 was recently made by the Commonwealth Fund.

MISS RUTH ATWATER, who for the last four years has had charge of the foods courses at Skidmore College, Saratoga Springs, New York, serving during the last year as director of the department of home economics, has been appointed director of the Bureau of Home Economics of the National Canners Association.

DR. CHARLES G. ABBOT left Washington on June 1 for Mt. Wilson, California, where he will continue his work on the stellar energy spectra, and on the solar cooker. He will probably return about October 1.

THE Tropical Plant Research Foundation has undertaken an investigation of the physiology, bark anatomy, and latex flow of the sapodilla tree and tapping problems connected with the production of chicle, supported by the Chicle Development Company of New York. Dr. John S. Karling, of the department of botany of Columbia University, is leaving for British Honduras to carry on the field work.

PROFESSOR JOHN W. HARSHBERGER, professor of botany in the University of Pennsylvania, sailed for South America on July 2, to conduct botanical study on the vegetation of that country. He will visit the tropical rain forest, the Araucaria forest of Brazil, the pampa of Argentine, the high Andes of Chili, the Antarctic forest of southern Chili, and on his return homeward, attention will be given to the lomas of the west coast of Peru.

DR. O. A. REINKING, pathologist of the United Fruit Company, Boston, has returned to the United States after two and one half years of exploration in the Philippine Islands, Southern Asia, India, Indo-Malaysia and Australasia relative to securing disease resistant varieties of bananas.

PROFESSOR DR. A. FUJINAMI, of the Kyoto Imperial University, has been appointed as exchange professor and has left Japan for South America to study sanitary conditions in Brazil.

DR. Y. SATA, formerly president of the Osaka Medical College, has been nominated exchange professor to Germany, and will give lectures on tuberculosis in several universities there. He also carries several reels of films produced by the education department showing ancient Japanese martial arts.

SIR FREDERICK KENYON delivered the Romanes lecture of the University of Oxford on June 17. He took as his subject "Museums and National Life."

DR. J. L. COLLINS, of the division of genetics, University of California, has returned from Vancouver, British Columbia, where he was invited by the Canadian Society of Technical Agriculturists to deliver two lectures on Experimental Genetics and Genetics in its Relation to Breeding.

DR. JOHN B. DEAVER, Philadelphia, was guest of honor at the dinner of Medico-Surgical Society of New York, on May 21, when he spoke on "Preventive Measures against Gastric Ulcer and Malignancy."

DR. CHARLES E. ST. JOHN recently gave a lecture on "The Evidence and the Bearing of the Theory of General Relativity" at Amherst College, and at Cornell University under the Schiff Foundation. He also spoke before the Physical Colloquium of Cornell University on "Some Characteristics of Solar and Stellar Atmosphere."

THE fiftieth annual convention of the Pennsylvania Forestry Association met at West Chester on June 28, under the presidency of Dr. Henry S. Drinker, president-emeritus of Lehigh University.

MR. GEORGE EASTMAN, of Rochester, has given $1,500,000 to establish a dental dispensary in London, England, which will be associated with the Royal Free Hospital. It probably will be much like the Rochester Dental Dispensary, Rochester, N. Y. The agreement provides that the British friends of the project raise funds to defray the running expenses of the institution. The activities of the dispensary are to be confined to a definite district in London which has a population of about 600,000, mostly poor and middle class persons.

MR. J. PIERPONT MORGAN and Mr. William H. Mattieson have provided funds for a world survey of epidemic encephalitis. With this object in view, a commission has been appointed consisting of Dr. Haven Emerson, professor of public health administration, Columbia University College of Physicians and Surgeons; Dr. Frederick P. Gay, professor of bacteriology, Columbia University College of Physicians and Surgeons; Dr. William H. Park, director, bureau of laboratories, New York City Health Department; Dr. Josephine B. Neal, director of research.

A 1,750-ACRE forest tract, situated not far from Ithaca, has been given to Cornell University by the heirs of Mathias H. Arnot, of Elmira. The tract will be under the supervision and management of the department of forestry of the university and will be used for purposes of research, demonstration and instruction. The major part of the tract is in Schuyler County, although its northern end is in Tompkins County. It lies in the watershed of the Susquehanna River.

A FIELD meeting of the Southern California Rift Club was held on Sunday, May 29, in the Narrows of the Cajon Pass between the San Gabriel Mountains on the west and the San Bernardino Mountains on the east. It was attended by over a hundred members and friends of the club, and was called to order by the president, Dr. Levi F. Noble, who introduced Professor J. P. Buwalda, of the California Institute of Technology, at Pasadena. Professor Buwalda gave a general account of the great San Andreas rift belt, which traverses the pass obliquely from west-northwest to east-southeast, and on which a displacement in the San Francisco region caused the earthquake of 1906; he emphasized the numerous sub-parallel faults which the belt includes in its width of a mile or more, and explained that, in consequence of complex movements upon them, many great slices and slabs of rock, more or less crusted by the pressure and friction to which they have been subjected during their displacement, are now found in discordant relation to each other and to the rock on either side of the belt. Professor W. M. Davis, of Harvard University, next spoke with especial regard to the contrast between rifts of the San Andreas type, which have nearly rectilinear traces, and on which movements with a large horizontal movement seem to predominate, and rifts of the Wasatch type, traces of which show a succession of concave bights separated by cusps and on which movements with a large vertical component prevail. Professor Davis also called attention to the importance of establishing monuments on the two sides of certain rifts at selected points, in order that future displacements may be detected. After a picnic lunch, Dr. Noble led the party up the nearby mountain slope, whence the course of the rift for several miles in both directions was pointed out, and where several great rock slabs of diverse composition and of large displacement in the rift belt were examined.

THE first zoological garden for Prague is to be established in Troja, one of the outer suburbs. Plans for the completion of the buildings extend over many years; but the exhibition of birds and animals is to be completed as soon as possible. Funds for this enterprise are being obtained partly by the formation of a company and partly by state aid. The total is estimated at about 2,000,000 crowns.

THE authorities of the Province of Saskatchewan are making arrangements for the preparation of a comprehensive geological air survey of the northern part of that province, according to advices to the Department of Commerce from Assistant Trade Commissioner W. J. Donnelly, at Montreal. The project, it is said, will be undertaken for the purpose of determining the mineral wealth of the district to be surveyed and, when the maps are completed, the mineralized areas will be indicated as an aid to prospectors interested in that region.

PRESIDENT COOLIDGE, by recent executive order, has set aside nine tracts of land in Alaska as game and bird preserves. Certain areas along the Alaska Railroad have been set aside as a preserve and breeding ground for muskrats and beavers, and a tract of 14 square miles about the government hotel at Curry, Alaska, which is also on the railroad, a refuge for the protection of wild birds and game and fur-bearing animals. In the area at Curry fishing will be regulated by the secretary of commerce; and the hunting and trapping of birds and game and fur-bearing animals, other than brown and grizzly bears, wolves and wolverines, will be permitted only under regulations to be prescribed by the secretary of agriculture, in accordance with the Alaska game law.

THE report of the committee presided over by Lord Lovat, which was appointed by the British Colonial Office Conference to make recommendations in regard to the establishment of a Colonial Scientific and Research Service, has been issued. The cost of such a service is estimated to be £175,000 a year. The committee proposes that a council should be set up under a chairman appointed by the Secretary of State for the Colonies, a director and deputy director and the following members: The director of the Royal Botanic Gardens, Kew; the director of the Imperial Bureau of Entomology; the director of the Imperial

Bureau of Mycology; a chemist; a representative of veterinary science; a representative of the Imperial Institute; a representative of the Colonial Office, and a representative of the Empire Marketing Board. The principal functions of the council would be to administer a Colonial Agricultural Research Service, which would include an Empire chain of research stations maintaining *liaison* with the Empire Marketing Board, the creation of a clearing house of information and the organization of a "pool" of scientific workers.

UNIVERSITY AND EDUCATIONAL NOTES

THE Massachusetts Institute of Technology is named residuary legatee in the will of Henry P. Talbot, professor of chemistry, who died on June 18. Mrs. Talbot receives $20,000, and is to have the income from the remainder and use of the home at 273 Otis street. At her death the trust is to be terminated and after $83,000 in private bequests are paid the institute is to receive the residue. While use of the money is not restricted, it is suggested that a part or the whole be used to assist junior instructors to attend meetings of societies representing their professions.

YALE UNIVERSITY receives a bequest, said to amount to nearly $500,000 under the will of Charles Colebrook Sherman, the income to be paid to Mrs. Sherman until her death or remarriage, when it is to be used for the maintenance of a fellowship. Mr. Sherman also left his library to the university.

AN additional gift of $250,000 for the building of the George Herbert Jones Chemistry Laboratory has been made to the University of Chicago by Mr. Jones. In December Mr. Jones gave the university $415,000 for the chemistry building which is to bear his name, and his added gift will make possible a larger structure, with consequent extension of facilities.

REORGANIZATION of the school of engineering at Oregon State Agricultural College has been effected by the board of regents with the establishment of an engineering experiment station and additional graduate work. Dean G. A. Covell, for thirty-four years a member of the state college faculty and head of the school of engineering since its establishment, has been made director of the experiment station and dean of the graduate work. S. H. Graf, professor of mechanics and materials, will be associate director. Harry S. Rogers, professor of hydraulics and irrigation engineering, formerly of the University of Washington, but for the last six years a member of the Oregon Agricultural College staff, has been advanced to the deanship of the undergraduate school.

AT the recent dedicatory exercises of the Montgomery Ward Memorial Building of Northwestern University Medical School, Dr. L. B. Arey was installed as the first incumbent of the Robert Laughlin Rea professorship of anatomy. This chair was established by Mrs. Mollie Manlove Rea in memory of her distinguished husband, who was held by his contemporaries as the foremost anatomical teacher of his time in the west. Dr. Sam L. Clark, assistant professor of histology and neuroanatomy at Washington University Medical School, has accepted an appointment as assistant professor of anatomy.

DR. EZRA J. KRAUS, professor of botany in the University of Wisconsin, has joined the faculty of botany in the University of Chicago.

DR. BURTON M. VARNEY, of the U. S. Weather Bureau, has resigned from the assistant editorship of the *Monthly Weather Review* to accept an associate professorship in geography in the University of California at Los Angeles.

THE department of neuroanatomy and histology of the Washington University School of Medicine which was established in 1924 has been reunited with the department of anatomy, the union to take effect during the year 1928. Dr. Robert J. Terry, professor of anatomy, will be in charge of the reorganized department.

A. S. BESICOVITCH, of the University of Leningrad, has been appointed university lecturer in mathematics at the University of Cambridge for three years.

DISCUSSION

THE CHATTANOOGAN AGE OF THE BIG STONE GAP SHALE OF SOUTHWESTERN VIRGINIA

IN 1924[1] the writer called attention to the fact that the Chattanooga black shale in the type area, Chattanooga and vicinity, Tennessee, is divisible into three parts: (1) an upper, thin black shale, (2) a central, gray clay shale, and (3) a lower, thicker black shale. The outcrops of the shale were traced continuously to Lafollette, Tennessee, and Cumberland Gap, Virginia-Tennessee, where the tripartite division was again found. Last summer the writer was able, through the generosity of a grant from the Smith Fund of the University of North Carolina, to trace the Chattanooga shale from Cumberland Gap to the type locality of the Big Stone Gap shale at Big Stone Gap, Virginia. As a result of this study the following facts were brought out:

[1] *Amer. Jour. Sci.* (5) 7, 1924, pp. 24–26, 30.

(1) The Big Stone Gap shale is a northward extension of the Chattanooga shale of the type area.

(2) The Big Stone Gap shale shows the same tripartite division as the Chattanooga shale of the type area, except that all three units are considerably thicker.

(3) In passing from Lafollette to Big Stone Gap the middle gray shale member thickens up, replacing the uppermost part of the underlying black shale member.

(4) The contact between the lower black shale and the gray shale is not a stratigraphic but an environmental break since the uppermost part of the lower black shale in the south interfingers with the gray shale which replaces it to the north. Thus both the gray shale and the replaced black shale are of the same age, differing only in the conditions of their deposition.

(5) The lower black shale thickens by underlap in passing to the north, so that the lower black shale at Chattanooga is only the uppermost part of the lower black shale member. As stated above, this uppermost part is of the same age as the middle gray shale member in southwestern Virginia.

(6) In Tennessee an unconformity separates the upper black shale from the underlying gray shale member. This unconformity has not been demonstrated in southwestern Virginia.

The completed study will appear in a later paper.

J. H. SWARTZ

UNIVERSITY OF NORTH CAROLINA

NOTES ON HELODERMA SUSPECTUM AND IGUANA TUBERCULATA

ON April 2, 1923, the writer received a poisonous lizard, *Heloderma suspectum*, from Wheelock, Robertson County, Texas. This village lies in the southeast part of the county on no highway and about twelve miles from the nearest railroad. This animal had been killed by a farmhand as it was crawling about on his land, and was brought by a student to the department of biology of the Agricultural and Mechanical College of Texas. The finding of this reptile in Robertson County so far from its native home is indeed interesting. Ditmars,[1] Gadow,[2] Hegner,[3] Hornaday[4] and Pratt,[5] limit the distribution of these animals to Arizona, New Mexico and northern Mexico. Only one other occurrence of the Gila Monster in Texas is recorded in the literature available to the writer. Cope[6] lists a specimen taken at Fort McDowell, Texas. This single find was referred to by Strecker[7] who comments somewhat skeptically on the report and states that he made careful search in favorable localities for these reptiles, but failed to find them in Texas. Any attempt to explain how this lizard found its way to Wheelock, some four or five hundred miles from its native haunts, would be mere guesswork.

The writer has lately received from Mr. L. T. Hunter, county agent, Childress County, Texas, another most interesting find—the common Iguana, *Iguana tuberculata*. This reptile was killed on a roadside near Childress and was sent to the Agricultural and Mechanical College of Texas on December 20, 1926. Childress County lies close to the eastern border of the Panhandle of Texas, touching the southwest corner of Oklahoma. This find is even more remarkable than the former, since the iguana was much farther from its native home—tropical America. The specimen measures three feet, nine and one half inches in length and apparently is only partly grown. Gadow states that *Iguana tuberculata* attains a length of five or six feet. Ditmars, Gadow, Hegner and Hornaday give the distribution as Central and South America and the West Indies, where it lives in trees. How such a reptile could find its way from its tropical and arboreal habitat in the jungles to the almost treeless plains of Childress, Texas, is an interesting speculation.

PENNOYER F. ENGLISH

AGRICULTURAL AND MECHANICAL
COLLEGE OF TEXAS,
COLLEGE STATION, TEXAS

[1] Ditmars, R. L., "Reptiles of the World," 1922.

[2] Gadow, H., "Amphibia and Reptilia," Cambridge Natural History, Volume 8.

[3] Hegner, R. W., "College Zoology," revised edition, 1926.

[4] Hornaday, W. T., "The American Natural History," 1904.

[5] Pratt, H. S., "Manual of the Vertebrates of the United States," 1923.

[6] Cope, E. D., "The Crocodilians, Lizards and Snakes of North America," Report U. S. National Museum, 1898.

[7] Strecker, J. K., "Reptiles and Amphibians of Texas," 1915.

A PROTEST AGAINST CRYPTIC TITLES AND INDIRECT LABELING OF FIGURES

IT is the usual thing to lodge complaints when established conventions are violated; but the writer wishes to point out that there are at least two conventions relating to form in scientific articles that could be violated with profit. This note sets forth a complaint against convention.

Many authors are prone to introduce their works to the scientific world in more or less uncertain terms. They handicap them with titles that are often cryptic in the extreme. For example, what does "A New Insect from Utopia" mean? Any one who has had

experience in assembling a bibliography of a particular field will appreciate this sort of thing. A title, especially of a supposedly scientific paper, should be concise. However, precision or conciseness in writing a title for a paper should not fall before undue brevity. The writer certainly would not advocate a return to medievalism in such matters; but titles can be clear and at the same time brief. With the title cited above as a horrible example compare *"Musca domestica,* a New Dipteran Insect from Utopia." A good title, then, should be as brief as possible and should convey a definite idea of the contents of the subjoined matter, and should always be used with general papers as well as with papers of a taxonomic nature.

Not very long ago a very excellent paper of considerable length and illustrated by well-drawn figures in a half-dozen or more plates came to me. This paper was a zoological thesis from one of the major universities of the country. As it happened to be along a line of especial interest to the writer, it was read with care. But the ease of reading and the degree of pleasure and profit enjoyed were seriously marred by the fact that the figures on the various plates were labeled with abbreviations and that one had to turn to a distant page to find the key to these abbreviations. It would have been bad enough had the key been on the page facing the plate, or at the bottom of the plate itself. Often, to make such a bad matter worse, the terms are not alphabetically arranged—they may even be omitted by error in some cases. Needless to say, a study of such plates involves a great deal of time, patience, labor and even temper. In many instances, unless such papers are of immediate interest, they go unread in so far as a careful examination of the plates is concerned.

In the plates above mentioned, it was noticed that there would have been plenty of room to spell the labels out in full directly on the face of the plates, thus doing away with the necessity for a key, and at the same time effecting a saving of labor and space in production and a saving of time and labor in the ultimate consumption. The artistic qualities of the drawings would not suffer in the least by such a procedure; on the other hand, accuracy and availability would be greatly enhanced.

The present system of indirect labeling of plates is archaic and absolutely unscientific. It should be changed to a system of direct labeling on the figures, together with any necessary explanatory matter (not a key) on the page *facing* the plate. Direct labeling can easily be carried out in all cases except possibly in those rare instances where the details are exceptionally small and numerous. In such cases the key should face the plate and it should be arranged in an alphabetical fashion.

It is to be hoped that those editors responsible fo matter of form such as the above in scientific seria will effect changes looking toward improvement.

C. T. HURST

DEPARTMENT OF ZOOLOGY,
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QUOTATIONS

IN SCIENCE I note that attention is again call to the need of indicating in public addresses the b ginning and the closing of a quotation. The ter "quote" and "unquote" are suggested by Mr. Arnold

Some years ago I knew a very intelligent you woman who used to inform us that her "bright sa ings"—some of them—were not original, by raisi both hands above her head with the first and seco fingers pointing upward. Her fingers were her "qu tation marks" and were very easily understood. have many times since thought that some such sig or signals would be useful for public speakers w wish to indicate when their quotation ends but do n care to say, "the quotation ends here." Probably bo hands are not needed for the signal, but both f speaker and for audience some conventional si would, it seems to me, be worth adopting.

S. FRANCIS HOWARD

NORWICH UNIVERSITY

THE METRIC SYSTEM

I READ with interest the letter of H. J. Page, the Rothamsted Experiment Station, England, SCIENCE for June 3, frankly confessing the gr advantages of the Metric System over our stu and inaccurate Anglo-American system of weights a measures, but explaining his use of the Anglo-Am can term of "quarter," &c., because his paper w intended for the agriculturists and not for scienti

I beg leave to commend to him the method adop by the *Journal* of the American Medical Associat by which one does not need the searching of dicti aries, etc.

In the text of this admirable *Journal* all weig measures, etc., are given in the Metric System follow immediately in a parenthesis, by the Anglo-Amer equivalent. This is gradually educating the pu to the Metric System.

I hope and believe that the day of its adoption drawing near.

W. W. KEE

PHILADELPHIA, PA.

QUOTATIONS

A BRITISH COLONIAL RESEARCH

THE report of the Committee on Scientific Research Services, which is published this morn

rks an important step forward in the scientific use British Colonial resources. The recommendations e been adopted by the Colonial Conference, and as which have been in the air for some time have w become definite proposals. There is still, of rse, a great deal to be done. The committee have rked under great pressure, and a further committ- will have to be set up to work out details. The onial governments have to give their consent and ange their contributions to the central pool. But main principles that there should be a chain of earch stations, like Trinidad and Amami, through- the Empire, with a central directing council in ndon, controlling a mobile reserve of men of ence, and that there should be an Imperial Scien- Service transcending colonial boundaries, have n accepted by the spokesmen of five-and-twenty onial governments.

The present plans are only for agricultural re- rch. Medicine and forestry have been left to the ently constituted Medical Research Committee and next year's Empire Forestry Conference. But s report has the added interest that its under- ng principles apply to all branches of scientific rk. It brings out three points that are very little preciated—how small a sum the colonial govern- nts spend at present on agricultural research as mpared with other governments; how valuable the de of the colonies is to Great Britain; and how sely the prosperity of that trade is dependent n agricultural progress. It is perhaps not sur- sing to hear that the United States already spends agricultural research over $21,000,000 a year, and t the figure is growing. It is more surprising to rn that, though entomology is one of the most im- tant and most highly organized branches of science the colonies, their combined expenditure on it is e more than half the £100,000 a year that the gov- ment of Egypt spends. Henceforth it is pro- ed that the Imperial government and the colonial ernments between them shall find £175,000 a year agricultural research. That is considerably more n is being spent in uncoordinated ways to-day. t the Empire Marketing Board has an appropria- n for research, and the money found by the Im- ial government is likely to prove an excellent in- tment for the taxpayers at home. The comple- ntary character of the trade between Great Britain d the Crown colonies makes an increase in their rchasing power particularly advantageous to in- try here. On the other hand the colonial govern- nts stand to gain out of all proportion to their tributions, for, while these contributions will be ed on their revenue, the services they will receive will be limited only by their needs and by the resources of the whole system. They will be able to command first-rate men of science without having to find their salaries, because, if the conditions of service envisaged by the committee are created, the varied and well-rewarded career which the Colonial Agricultural Research Service will offer will enable it to attract the finest talent. The advantage will be greatest to the poorest colonies, for there is no natural connection between a colony's financial strength and the urgency of its need for scientific help. Moreover work well done in one colony is more often than not of value to other colonies, and the arrangements for more efficient intelligence service will make this more than ever obvious. Thus both in the science of soils and in plant genetics—"where," says the committee, "no organization of any kind at present exists"—the gain of one colony is likely to prove the gain of all. For this reason, if for no others, the proposals are plainly of interest to those Dominion governments who have similar questions of their own; and there is every reason for believing that what is now being set on foot for the Crown colonies will come in time to cover the whole Empire.—*The London Times.*

SCIENTIFIC BOOKS

A Bibliography of American Natural History. The Pioneer Century, 1769–1865. By MAX MEISEL. Vol. II. Brooklyn, The Premier Publishing Company, xii + 741 pp.

THIS, the second volume of Mr. Max Meisel's interesting and valuable contributions to the bibliography of the natural sciences in the United States, is in reality a history of the rise and development of the biological sciences in the first half of the last century in this country. It includes also the earth sciences and the exploring expeditions which were often concerned with technical scientific matters as well as with geographical and military or naval affairs. The multiplication of organizations, such as scientific societies and academies, and of various enterprises, such as museums, botanical and zoological gardens, institutes, state surveys, and exploring expeditions, was remarkable in the various parts of the United States from 1800 to 1844. Whereas, from 1769 to 1800 only ten such enterprises were founded, in the period from 1800 to 1844 one hundred and twenty were started on their career. Of these, sixteen were U. S. Government Exploring Expeditions. State geological and natural history surveys followed with the rise of state consciousness. The first state geological survey was that established in North Carolina in 1823. Other states followed in rapid suc-

cession, South Carolina in 1824, Massachusetts in 1830, Tennessee in 1831, Maryland in 1833, Connecticut, New Jersey and Virginia in 1835, Georgia, Maine, New York and Pennsylvania in 1836, Delaware, Indiana, Michigan and Ohio in 1837, Rhode Island in 1838, New Hampshire, Iowa, Illinois and Wisconsin in 1839, and Vermont in 1844. Three botanical gardens were opened in the first decade of the last century. The major line of activity was, however, very largely the formation of local scientific societies, academies, institutes and museums. These were the natural outgrowth of local enterprise and ambition and were obviously the most practical type in a period when travel was both expensive and time-consuming.

While there are these marked developments of state and local enterprises, there is at the same time a noticeable absence of federal activities, aside from exploring expeditions which usually utilized the federal army or navy personnel and guidance; and of national societies. Two notable exceptions to this are the American Philosophical Society (1769) and the American Academy of Arts and Sciences (1780).

In the period from 1769 to 1844, and mainly after 1800, no less than 65 societies, lyceums, institutes, and the like, with state, county, city, or institutional designations in their names, were formed. Many of these were short-lived, a few now continue to function abreast of the times, and a number of others seem to have acquired the status of ancient and honorable desuetude. The close of this period saw the dawn of national solidarity in scientific matters with the formation of the Association of American Geologists and Naturalists (1840), out of which grew the American Association for the Advancement of Science and the National Institution for the Promotion of Science (1840), the predecessor of the Smithsonian Institution.

Scientific journals and publishing enterprises also multiplied in this period. Fourteen such serials, not professedly attached to institutions, were established between 1800 and 1844. Of these all but one, *The American Journal of Science,* have vanished, often after a brief career. They lacked the environing conditions and institutional continuity to enable them to survive in the struggle for pabulum and patronage.

The bibliographer and librarian will find in this volume a valuable record of the fugitive publications of the early expeditions, the state surveys and the ephemeral societies and lyceums which sprang up throughout the Republic in its early days from Portland to Little Rock. The investigator will find here accurate citations of all papers on subjects in natural history in practically all of the serials issued by the scientific agencies in the United States published prior to 1845. The historian of this scientific age will find here, in so far as names and titles can express it, an epitome of the pioneer days of American science.

CHARLES A. KOFOID
UNIVERSITY OF CALIFORNIA

SPECIAL ARTICLES

EFFECT OF SHORT ALTERNATING PERIODS OF LIGHT AND DARKNESS ON PLANT GROWTH

IN earlier papers dating from 1920, it has been shown that the relative length of the day and night may profoundly affect the course of development of plants. With many species flowering and fruiting may be hastened or retarded by appropriate regulation of the daily period of illumination. In some plants flowering is favored by relatively short days while in others reproductive activity is induced by long days. Thus it was found that plants normally flowering during the fall or winter may be readily caused to flower in midsummer by excluding the early morning or late afternoon light for a few hours each day. When, however, these plants were darkened for a like number of hours during the middle of the day the vegetative period was not materially shortened. In this respect the plants behaved about the same as if they had remained in the light throughout the day. It appears that with the same total number of hours of daily illumination two shorter periods of light do not produce the same effect as a single uninterrupted light period. The view has been previously expressed that the length of day effect is not due simply to the total quantity of light energy received by the plant and additional evidence in support of this view is seen in the results of recent experiments having to do with the response of plants to variations in the distribution of a given number of hours of illumination through the 24-hour period. Considerable work will be required to complete these studies but it seems desirable to report briefly at this time some of the results thus far obtained. It has been previously shown that in June plantings of the Biloxi variety of soybeans the normal vegetative period at Washington is 80 to 90 days while exposure to a daylight period of 8 to 12 hours may induce flowering in 20 to 25 days. Similar plantings were darkened daily from 10 a. m. to noon and from 2 to 4 p. m. As compared with the full length of day of summer this treatment not only failed to hasten flowering but actually delayed it by two weeks. On the other hand when these and other plants of similar behavior were exposed to the full daylight period, but on alternate days only, the vegetative period was materially shortened, although not to the extent effected by

short daily illumination period. Experiments were next undertaken with uniform, relatively short alternating periods of light and darkness, using for the purpose small light-proof compartments, with 1,000-watt Mazda lamps as the light source. Excess radiant heat energy from the lamps was prevented from reaching the plants by interposing a 2-inch screen of rapidly flowing clear water. Light intensities of 3,000–4,000 foot candles at normal temperatures were thus provided. Special timing devices were used for automatically turning the lights on and off at the proper intervals. As a standard of comparison for the shorter intervals, 12 hours of illumination alternating with 12 hours of darkening was used and in some instances continuous illumination also was employed. In addition to Biloxi soybeans, the Mandarin which readily flowers in the long days of June (at Washington) and the Peking variety, normally flowering under a somewhat shorter day, were included in the tests. With a 6-hour alternation of light and darkness the vegetative period of Mandarin was increased from 22 days (12-hour controls) to 34 days and the height was increased from 25 inches to 45 inches. Neither the Peking nor the Biloxi showed flower buds at the end of 51 days although their respective heights were 42 and 40 inches. The 12-hour controls flowered in 23 and 43 days, respectively, and their heights were 29 and 51 inches. In Rudbeckia bicolor, a plant in which flowering is favored by very long days, the vegetative period was reduced from 70 days to 37 days by the 6-hour alternation and the number of blossoms was considerably increased although the average size of the blossoms was reduced. In these tests the mean daily temperature ranged from 69° to 72°, with extreme daily ranges seldom departing from the mean by more than 5 degrees and without important differences between the two compartments. With a 4-hour alternation of light and darkness Mandarin and Peking soybeans gave similar results. Experiments were then made with alternating light and darkness intervals of 1 hour, 1 minute, and 15 seconds, respectively. In several tests running from 36 to 53 days the Mandarin flowered after considerable delay under the 1-hour alternation, as measured by the vegetative period under the 12-hour interval, but failed to flower under the two shorter intervals. Biloxi soybeans failed to flower under any of the short alternations. In contrast with the effect on soybeans, reproductive activity was materially hastened in Rudbeckia bicolor by the short alternations of light and darkness. Moreover, the vegetative period was about the same as under continuous illumination. In one test the vegetative period under short alternations and under continuous light ranged from 31 to 37 days, as compared with 56 days under the 12-hour alternation. The average height of the plants was 40 inches under continuous illumination and 20 inches under each of the light-darkness alternations. Summing up, it is apparent that with the plants in which flowering is favored by short days as well as with those in which the opposite is true, the general effect of the relatively short alternations of light and darkness on reproductive activity is much the same as that produced by long days or continuous illumination. There is no suggestion of a short-day effect. However, the short light-darkness alternations may bring about more or less serious nutritional disturbances and growth relations are markedly affected. A striking feature of these tests with soybeans and Rudbeckia and with *Cosmos sulphureus* has been the chlorotic, weak, spindling type of growth produced by the short light-darkness alternations, which is especially marked under the 1-minute interval. These effects seem to increase with decrease in the duration of the alternation until a climax is reached with the 1-minute interval. Curiously enough, the type of growth is much improved again with the 15-second interval. Evidently, assimilation and other functions may be much disturbed under relatively short alternations of light and darkness. In this connection it is of interest to note that Warburg (Biochem. Zeitschr., v. 100, 1919, p. 230–270), working with Chlorella under very short illumination intervals, did not obtain the normal average rate of assimilation found for continuous illumination till the alternations were reduced to a length of about .004 second. Under the 1-minute interval in our tests with soybeans leaf development was poor, the leaves being reduced in size, chlorotic and showing large splotches of dead tissue. The stems were slender and weak. Cosmos showed much the same characteristics in leaf and stem. Larger plants of Rudbeckia showed somewhat less leaf injury but small seedlings were unable to survive at all under the 1-minute interval. Taking 100 to represent the average dry weight of the above-ground parts of Rudbeckia under the 1-minute interval, in a typical case, the corresponding values for the 15-seconds, 1-hour and 12-hour intervals were 150, 175, and 250, respectively. Similarly, with 100 as the dry weight of tops produced by Biloxi soybeans at the end of 21 days under the 1-minute interval, the corresponding values for the other intervals were 190, 280, 280, respectively, and 310 for continuous illumination. Similar, though somewhat larger, differences under the different exposures were obtained with Cosmos. Interesting contrasts in relative growth of root and top were shown by the soybeans and cosmos under the different light exposures. In the soybeans root development was very poor under the 1-minute and 15-seconds exposures, the

ratio of root to top being 1:7. On the other hand, the dry weight of roots produced by cosmos under these intervals greatly exceeded that of the tops, the proportion being 1:.3–.4. Under the other exposures the ratio of root to tops remained nearly constant and was about the same for both plants, namely, 1: 3.0–4.0. The combined dry weight of root and tops of cosmos was the same for all alternations of light and darkness and slightly less than half of that produced under continuous illumination. With the soybeans this relation did not hold, the combined dry weight produced under continuous illumination being only slightly greater than that under the 12-hour and 1-hour alternations while the combined weight under the 1-minute alternations was relatively quite small. The effect on the growth and nutrition of the plant, at least in some particulars, suggests that commonly produced by weak light, although the leaf injury possibly could be considered as indicating excess illumination. There seems to be no feature resembling the typical short-day effect except possibly that on root growth in cosmos. These tests are being further elaborated and it will be of interest to study the effects of various other alternations with both equal and unequal durations of the light and darkness intervals.

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IRON ORGANISMS

DURING the last two years we have endeavored to investigate iron organisms of the Gallionella group (Toxothrix, Spirophyllum, etc.).

In the course of the work it became clear that a medium consisting of tap water (pH = 7.6) and iron filings was beneficial to their growth.

The air carries, as spores or cysts, many iron organisms. This was demonstrated by sucking outside air through sterile culture flasks. Within five days cultures appeared, among which the curious Toxothrix, described by Molisch[1] from Japan, was conspicuous.

The natural occurrence of iron organisms around Stanford University seems to be related to aeration of deep waters, either through cracks in a reservoir dam or from deep wells and springs. In the former case aeration of the hydrotroilite black mud, containing large amounts of $(FeS)_x$ $(H_2O)_y$ causes a formation of H_2S, while the oxidation of ferrous iron goes parallel with a noticeable acidification of the aerated water (pH changes from 7.6 – 6.8).

The reactions involved are either

$$4FeCO_3 + 6H_2O + O_2 = 4Fe(OH)_3 + 4CO_2$$
$$4Fe(HCO_3)_2 + 2H_2O + O_2 = 4Fe(OH)_3 + 8CO_2$$

As soon as the pH drops below 7 the black s pended hydrated pyritite will begin to decompose.

It was at first thought that this fairly acid medi constituted the normal environment for the org isms. This view seemed to derive support from observation that Fe^{+++} becomes soluble at pH while Fe^{++} becomes soluble around pH <6.2. T fact was checked with various organic and inorga salts with fairly consistent results. The availabil of Fe^{++} for the alleged autotrophonts would be course greater at a lower pH.

However, cultures were very successful up pH = 9.2 with an optimum activity around pH = Here less than one part of Fe^{++} in 5×10^6 water present, as checked by colorimetric determinati Therefore, if the organism is able to use iron in metabolism, it has to lower the pH locally so as make it soluble.

A series of experiments was carried out in wh the increase in weight of infected and sterile media (c.p. iron filings, Cu-free, in tapwater) established. It appeared that no acceleration of oxidation in the infected media could be observed an eighteen-day run, although cultures developed n mally. Our microscopic findings check Cholod work.[2] We observed, however, that the terminal ganism may swarm, sometimes over a rather l area. It will settle down and begin to form a stalk, which may be independent or become attac to the old stalk when the excreted mass increa The terminal organisms are very small (.8 × .5 Directly below the terminal cell the stalk is incrustated. Incrustation starts in patches, ha ever gradual.

Both Molisch and Cholodny deny the presence a core in the sheath and claim that the entire Ga nella is soluble in "dilute" acids. Unfortunately, H^+ concentration of their solutions is not menti in their papers.

It was soon found that by using various acids pH close to 5 (acetic, lactic, citric, butyric, tart the sheath will dissolve, leaving a thin glistening We believe that Cholodny's comparison of the Ga nella group with certain flagellates (Anthop Phalansterium, Spongomonas, Rhipidodendron) significant one.

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[1] Molisch, H., Rep. Imp. Tohoku. Univ. Japan Series I. 2, 1925.

[2] Cholodny, N., Die Eisenbakterien. Jena. G Fischer, 1925.

THE IOWA ACADEMY OF SCIENCE

THE forty-first annual meeting of the Iowa Academy of Science was held with the State University of Iowa, at Iowa City on May 6 and 7, 1927, with members and visitors in registered attendance.

Special features of the general meeting were: president's address, "The Evolution of an Idea," Dean C. E. Seashore, in which he traced the idea t a specific trait can be measured quantitatively; ew Interpretations of Glacial Deposits in Iowa," Dean George F. Kay, dealing with the present tus of the Iowan drift problem; "The Rise of Sap Plants," by Professor A. L. Bakke; and the annual iday evening lecture by Professor E. C. Stakman the University of Minnesota on "Racial Specialion of Pathogenic Fungi."

The reports of the standing committees on conseron and publicity in high schools concerning rerch careers in science were especially timely and rough.

President D. W. Morehouse, of Drake University, awarded a grant from the Academy Research nd[1] of $200, or as much thereof as may be necesy, for the investigation of a nebula (dark) in gnus.

The officers and section chairmen for the forthcomyear are as follows:

Officers

President—L. D. Weld, Cedar Rapids.
Vice-president—G. F. Kay, Iowa City.
Secretary—P. S. Helmick, Des Moines.
Treasurer—A. O. Thomas, Iowa City.
Editor—G. H. Coleman, Iowa City.
American Association for the Advancement of Science presentatives—D. W. Morehouse, Des Moines; and E. Seashore, Iowa City.

Section Chairmen

acteriology—C. H. Werkman, Ames.
otany—R. A. French, Dubuque.
hemistry—N. O. Taylor, Iowa City.
eology—F. A. Wilder, Grinnell.
athematics—Roscoe Woods, Iowa City.
hysics—J. A. Eldridge, Iowa City.
sychology—J. E. Evans, Ames.
oology—H. W. Norris, Grinnell.

The Academy convened in nine different sections the presentation of 178 papers of special inter- Reports from these special sections, prepared the retiring section chairmen, follow:

[1] This fund is made possible by the American Assoion for the Advancement of Science refund of 50 for each Iowa Academy-American Association for Advancement of Science member.

BACTERIOLOGY

(By Jack J. Hinman, Jr., Iowa City)

The address of the retiring section chairman concerned the development of our present ideas for the measurement of the quality of water. The outstanding paper of the session was probably that by Dean R. L. Buchanan, of Ames, entitled, "Common errors in the application of physico-chemical concepts to the physiology of bacteria." Other important discussions were on the bacterial blackening of canned vegetables by C. H. Werkman and Helen J. Weaver; the germicidal efficiency of alkaline washes used in cleaning beverage bottles by Max Levine, J. H. Buchanan, Grace Lease and E. E. Peterson; and on soil bacteriology by L. W. Erdman, R. H. Walker and Harry Humfield. Medical phases of work were the subjects of papers by C. S. Linton who discussed the detection of trichina, and by H. D. Palmer who described two cases of mycotic infection which had come under his observation.

BOTANY

(By G. W. Wilson, Fayette)

The program of the botanical section was varied and of exceptional interest. Castetter continued his reports on the germination of cucurbit pollen, Bakke compared inhibition in sweet and field corn, and the synthesis of amino acids in plants was presented by Loehwing. Wylie continued his studies on cicitarization of leaves, and leaf fall in Populus was studied by Marts.

Ecological papers were presented by Pammel, Shimek and Miss Hayden; Miss Blagg gave a preliminary list of Mosses of Iowa, Prescott a similar list of Algae; and Martin presented studies on various fungi.

CHEMISTRY—INORGANIC AND PHYSICAL

(By Jacob Cornog, Iowa City)

The most novel research among the thirty reported at the Inorganic and Physical Chemistry Section was by Poulter and Frazer. In this investigation they allowed zinc to come in contact with sulphuric acid under a pressure of 16,000 asmospheres and obtained hydrogen sulphide as one of the end products.

ORGANIC CHEMISTRY

(By Henry Gilman, Ames)

G. H. Coleman and D. Craig obtained nitrogen, ammonium chloride, benzalacetophenone dichloride and a C-chloro-N-di-chloroamino ketone from the reaction between nitrogen trichloride with benzalace-